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URS Corporation
756 East Winchester Street, Suite 400
Salt Lake City, UT 84107

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Hill Air Force Base
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Hill AFB UT 84056

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14. ABSTRACT

Under the proposed action, new facilities would be constructed to accommodate the F/A-22 workload of up to 54 aircraft per year. Included would be the construction of a nondestructive inspection (NDI) facility and the relocation of the existing FPS-117 radar tower. Under the no-action alternative, the proposed F/A-22 complex would not be constructed.

The no-action would result in insufficient facilities to adequately sustain Hill AFB's F/A-22 mission. Based on the findings of this EA, construction of the F/A-22 maintenance hangar, NDI facility, and fire station, and relocation of the radar tower at Hill AFB are not expected to have any significant and unavoidable adverse environmental impacts. A Finding of No Significant Impact (FONSI) statement was prepared.

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Hill Air Force Base, Utah

Final

Environmental Assessment for the Proposed F/A-22 Maintenance Facilities Hill Air Force Base, Utah

September 2005

FINAL

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED F/A-22 MAINTENANCE FACILITIES

September 2005

Prepared for:

Ms. Kay Winn
75 CEG/CEVOR
7274 Wardleigh Road
Hill AFB, UT 84056-5137

USAF Contract No.: F42620-00-D-0028
Delivery Order No.: 0016

Prepared by:

URS Corporation
756 East Winchester Street, Suite 400
Salt Lake City, UT 84107

FINDING OF NO SIGNIFICANT IMPACT FOR THE PROPOSED F/A-22 COMPLEX AT HILL AIR FORCE BASE, UTAH

Description of the Proposed Action

The Air Force has designated Hill Air Force Base (AFB) as a depot-level sustainment repair site for the F/A-22 aircraft. Hill AFB does not currently possess sufficient facility capacity to support the overhaul, testing, and repair of the new aircraft and its components. The overhaul/repair activities required include aircraft disassembly, cleaning, inspecting, reassembly, and operational testing. The purpose of the proposed action is to provide sufficient facilities at Hill AFB to support depot-level sustainment repairs to the new F/A-22 aircraft and its component parts in support of the U.S. Air Force. Without the proposed composite fighter aircraft hangar, Hill AFB would lack the necessary resources to meet demand for advanced composite repairs, manufacturing, and modifications.

Under the proposed action, new facilities would be constructed to accommodate the F/A-22 workload of up to 54 aircraft per year. Included with the new hangar construction would be the construction of a non-destructive inspection (NDI) facility (to house the Radar Cross Section (RCS) operations) and the relocation of the existing FPS-117 radar tower. Construction of a 3-bay fire station would occur at a later date. Under the no-action alternative, the proposed F/A-22 complex would not be constructed. The no-action would result in insufficient facilities to adequately sustain Hill AFB's F/A-22 mission.

Summary of Environmental Impacts of the Proposed Action

Surface Water

The proposed action would have no significant adverse impact on surface water quality in the area. There may be minor, short-term impacts due to increased sediment runoff associated with ground-disturbing activities during construction. These would be kept to a minimum with the use of standard construction practices, which include:

- Minimizing the size of the disturbed area associated with the construction site;
- Stockpiling removed soils and protecting them from wind and water erosion; and
- Replacing stockpiled soils, where possible, following construction.

Additionally, since the disturbed area associated with the proposed action encompasses more than five acres, a Utah Pollutant Discharge Elimination System General Permit for Stormwater Discharge Associated with Construction Activity would be required.

Groundwater

The proposed action would have no adverse impacts on groundwater quality. New facilities would include necessary containment to prevent aircraft operations from impacting groundwater. All process wastewater would be sent to Hill AFB's industrial wastewater treatment plant.

Soils

The proposed action would have no significant adverse impact on soils in the area. Minimal impact would result from developing approximately 25 acres of undeveloped land east of the runway for the proposed repair hangar and engine testing area. There may be minor, short-term impacts as a result of soil erosion associated with ground-disturbing activities during construction, but these would be kept to a minimum with the use of standard construction practices described above.

Vegetation
The proposed action would have no significant adverse impact on vegetation in the area. The area where the proposed maintenance hangar would be constructed is not currently developed. Constructing the repair hangar and supporting facilities would impact approximately 25 acres of native grasses found in undeveloped areas of the Base. No endangered or threatened vegetative species reside at the proposed action sites.

Wetlands
The proposed action would have no impact on wetlands. There are no wetlands in the vicinity of the proposed action.

Air Quality
The proposed action would have no significant impact on air quality. Elevated levels of particulate matter from construction activities would be kept to a minimum with the use of appropriate dust control measures, such as watering and/or chemical stabilization. The combustion emissions from heavy-duty construction equipment would be short-term and would not result in any exceedences of applicable air quality standards. In addition, no significant short-term or long-term impacts to local or regional air quality conditions are expected to occur when the F/A-22 operations are implemented. Increases in oxides of nitrogen (NO_x) and volatile organic compounds (VOC) emissions from non-permitted/mobile sources would be considered *de minimis*, and no conformity rule evaluation is required. Emission increases from permitted sources would not exceed existing requirements found under the Title V Operating Permit for Hill AFB. However, the existing Title V Operating Permit would have to be updated to include the new equipment that would be housed in the F/A-22 Hangar.

Wildlife
The proposed action would have no significant adverse impact on wildlife. No threatened or endangered species reside at the site.

Cultural Resources
The proposed action is not expected to have any adverse impact on cultural resources. No known cultural resources exist near the proposed action sites.

Land Use
The proposed action would have no adverse impact on land use. Constructing the repair hangar would require developing approximately 25 acres of unused land east of the runway. The proposed activities would occur within the airfield buffer zone and would not alter the designation of existing facilities or areas.

Noise
The proposed action would not have significant adverse impact on noise levels in the area based on the relatively small percentage increase in aircraft take-offs and landings and personnel vehicle miles traveled.

Health and Safety
Worker health and safety hazards present during the proposed action would be typical of construction activities. All Occupational Safety and Health Administration (OSHA) requirements would be followed during construction work to minimize the potential risks. During facility operations, implementation of required safety procedures would assure appropriate worker protection. There would be no significant long-term adverse impacts to health and safety.

Transportation
The proposed action would have no significant adverse impact on transportation at Hill AFB. The proposed F/A-22 workload increase would result in an increase in employee traffic and parking requirements.

Transportation
The proposed action would have no significant adverse impact on transportation at Hill AFB. The proposed F/A-22 workload increase would result in an increase in employee traffic and parking requirements. However, a new parking lot will be constructed as part of the maintenance hangar.

Socioeconomics
The proposed action would have no significant adverse impact on the local economy or employment. Beneficial impacts include the addition of 400 to 600 jobs.

Cumulative Impacts
The proposed action, in conjunction with the current aircraft operations and development at the Base, is not expected to have any significant cumulative adverse impacts on the environment. The additional air emissions will not cause any violations of the Base's Operating Permit or any exceedences of local or regional air quality standards. In addition, noise levels are not expected to increase over existing aircraft noise levels. All other impacts are associated with construction activities and are expected to be short-term.

Air Quality: No significant short-term or long-term impacts to local or regional air quality conditions are expected to occur when the F/A-22 operations are implemented. Increases in NOx and VOC emissions from non-permitted /mobile sources would be considered *de minimis*, and no conformity rule evaluation is required. Cumulative emission increases from permitted sources would not exceed the requirements imposed by the Title V Operating Permit from the State Air Quality.

Noise: The addition of the F/A-22 aircraft will constitute a slight increase in annual aircraft operations and employee traffic at the Base. With the addition of the relatively small number of F/A-22 operations and vehicle miles traveled, no adverse aircraft or traffic noise impacts are anticipated.

Conclusion
Based on the results of this Environmental Assessment, no significant impacts are expected from the proposed F/A-22 workload. Therefore, in accordance with Air Force Instruction 32-7061, a Finding of No Significant Impact (FONSI) may be issued. Preparation of an Environmental Impact Statement (EIS) is not necessary.

Hill Air Force Base, Utah

Authorized Signature

Date

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AGE	Aerospace Ground Equipment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO	carbon monoxide
CFR	Code of Federal Regulation
DCE	cis-dichloroethylene
DoD	Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
HAP	Hazardous Air Pollutant
IRP	Installation Restoration Program
IWTP	Industrial Wastewater Treatment Plant
MW/cm^2	megawatts per square centimeter
NAAQS	National Ambient Air Quality Standards
NCA	Noise Control Act
NEPA	National Environmental Policy Act
NDI	non-destructive inspection
NO_x	nitrogen oxide
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCE	perchloroethylene
PEG	potential exposure group
PM_{10}	particulate matter (less than 10 microns)
ppm	parts per million
RF	radio frequency
SO_x	sulfur oxide
SORAP	Source of Repair Assignment Process
TCE	trichloroethene

UAC	Utah Administrative Code
UDAQ	Utah Division of Air Quality
VOC	Volatile Organic Compound
μg/l	micrograms per liter

EXECUTIVE SUMMARY

The Air Force has designated Hill AFB as a deport-level sustainment repair site for the F/A-22 aircraft. Hill AFB does not currently possess facility capacity to support the overhaul, testing, and repair of the new aircraft and its components. The overhaul/repair activities required include aircraft disassembly, cleaning, inspecting, reassembly, and operational testing. The purpose of the proposed action is to provide sufficient facilities at Hill AFB to support sustainment repairs to the new F/A-22 aircraft and its component parts in support of the U.S. Air Force. Without the proposed composite fighter aircraft hangar, Hill AFB would lack the necessary resources to meet demand for advanced composite repairs, manufacturing, and modifications.

Air Force instructions require Environmental Assessments (EAs) to be completed for all proposed Air Force actions that could potentially result in adverse environmental impacts. Under the proposed action, new facilities would be constructed to accommodate the F/A-22 workload of up to 54 aircraft per year. Included with the new hangar construction would be the construction of a non-destructive inspection (NDI) facility (to house the Radar Cross Section (RCS) operations) and the relocation of the existing FPS-117 radar tower. Construction of a 3-bay fire station would occur at a later date. Under the no-action alternative, the proposed F/A-22 complex would not be constructed. The no-action would result in insufficient facilities to adequately sustain Hill AFB's F/A-22 mission.

Section 1 of this report presents the purpose and need for the proposed action. It also includes background information on the proposed action location.

Section 2 describes the proposed action and the alternative actions that were considered. Selection criteria for evaluating reasonable alternatives are also presented in this section.

Section 3 describes the existing environmental conditions at the site of the proposed action.

Section 4 identifies the anticipated environmental impacts of the proposed action and the no-action alternative.

Section 5 is the list of report preparers, Section 6 is the list of persons contacted, and Section 7 includes the references cited in this report.

The anticipated environmental consequences of the proposed action are summarized in Table ES-1. Based on the findings of this EA, construction of the F/A-22 maintenance hangar, NDI facility, and fire station, and relocation of the radar tower at Hill AFB are not expected to have any significant and unavoidable adverse environmental impacts. A Finding of No Significant Impact (FONSI) statement has been prepared and is included at the beginning of this report. Preparation of an Environmental Impact Statement (EIS) is not necessary.

Table ES-1. Anticipated Environmental Consequences

Environmental Issues	Impacts from Proposed Action	Impacts from No-Action Alternative
Surface Water	Potential short-term increase in erosion and sediment runoff in the storm water drainage system from ground-disturbing activities. No long-term impacts.	No impact.
Groundwater	No adverse impacts.	No impact.
Geology and Soils	Potential short-term increase in erosion and sediment runoff from ground-disturbing activities. Approximately 25 acres of disturbed land is expected. No significant adverse impacts.	No impact.
Vegetation	Minor impacts associated with construction activities on currently undeveloped grassy areas. Approximately 25 acres of disturbed area is expected. No significant adverse impacts.	No impact.
Wetlands	No adverse impacts.	No impact.
Air Quality	Short-term fugitive emissions during construction activities. No significant adverse impacts.	No impact.
Wildlife	No significant adverse impacts.	No impact.
Cultural Resources	No anticipated impact. Ground-disturbing activities will be monitored for artifacts; work will stop if any found.	No impact.
Land Use	New hangars would be constructed in undeveloped areas near the runway in the airfield buffer zone and in aircraft operations and maintenance areas. No adverse impacts.	No impact.
Noise	No significant adverse impacts.	No impact.
Health and Safety	Short-term hazards associated with construction activities. No significant adverse impacts.	No impact.
Transportation	An increase in commuter vehicles is expected from the workload associated with the maintenance hangar. No significant adverse impacts.	No impact.
Socioeconomics	No adverse impact. Beneficial impacts include the creation of 400 to 600 new jobs at the Base.	No impact.
Environmental Justice	No adverse impacts.	No impact.

Section 1
PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 Background

Hill Air Force Base (AFB) is located in northern Utah about 25 miles north of Salt Lake City and approximately 5 miles south of Ogden (Figure 1-1). It was established by Congressional order in 1935 and was constructed adjacent to the Ogden Army Arsenal beginning in 1940. In 1955, the Ogden Army Arsenal was transferred from the U.S. Army to the U.S. Air Force, doubling the size of the Base to a total of almost 6,700 acres and 1,171 buildings. The mission of Hill AFB centers on the maintenance and management of aircraft and missiles. Base industrial facilities support aircraft, missile, vehicle, and railroad engine maintenance and repair operations.

Hill AFB provides worldwide engineering and logistics management for the A-10 and F-16 fighter aircraft and maintains A-10, F-16, and C-130 aircraft. Maintenance operations for these aircraft include both general repair and paint/depaint operations. In addition to the A-10, F-16 and C-130 specific maintenance operations, Hill AFB repairs hydraulics, avionics, and instrument and electronic equipment, and provides overhaul and repair of landing gear for all U.S. Air Force aircraft and approximately 70 % of Department of Defense (DoD) aircraft.

Hill AFB proposes to construct a new aircraft maintenance hangar and associated facilities at Hill AFB to accommodate the new F/A-22 aircraft workload. The new facilities would consist of a medium bay maintenance hangar with concrete foundation, floor slab, structural steel frame, insulated walls, roof, and hangar doors. The hangar would include a RCS test cell, paint/depaint docks, fuel/defuel docks, flight test docks, restrooms, break area, and administrative offices. This project also includes the construction of a hush house and relocation of the existing FPS-117 radar system dome. Associated with the new hangar, but to be constructed at a later date, is a three-bay fire station. The facility location would comply with the DoD Force Protection standards of Air Force Instruction (AFI) 31-210, *Anti-Terrorism/Force Protection*. Figure 1-1 shows the general location of the proposed action at Hill AFB.

A hush house is also being constructed as part of the F/A-22 workload, but this facility is being assessed in a separate EA.

1.2 Purpose and Need for the Proposed Action

The F/A-22 is a new weapon system and requires new depot support workloads. The fleet is expected to eventually contain between 180 and 300 aircraft. The Air Force estimates that at full capacity, 54 F/A-22 aircraft will need repair-level maintenance each year. The aircraft will start requiring depot repair or modification of up to 7 aircraft by 2006, with full operations required by 2012.

The Air Force has designated Hill AFB as the depot repair site for the F/A-22. Hill AFB does not currently possess sufficient facility capacity to support the overhaul, testing, and repair of the new aircraft and its components. The overhaul/repair activities required include aircraft disassembly, cleaning, inspecting, reassembly, and operational testing. The purpose of the proposed action is to provide sufficient facilities at Hill AFB to support depot-level sustainment repairs to the new F/A-22 aircraft and its component parts in support of the U.S. Air Force. Without the proposed collocated composite fighter aircraft hangar, Hill AFB would lack the necessary resources to meet demand for advanced composites repair, manufacturing, and modification.

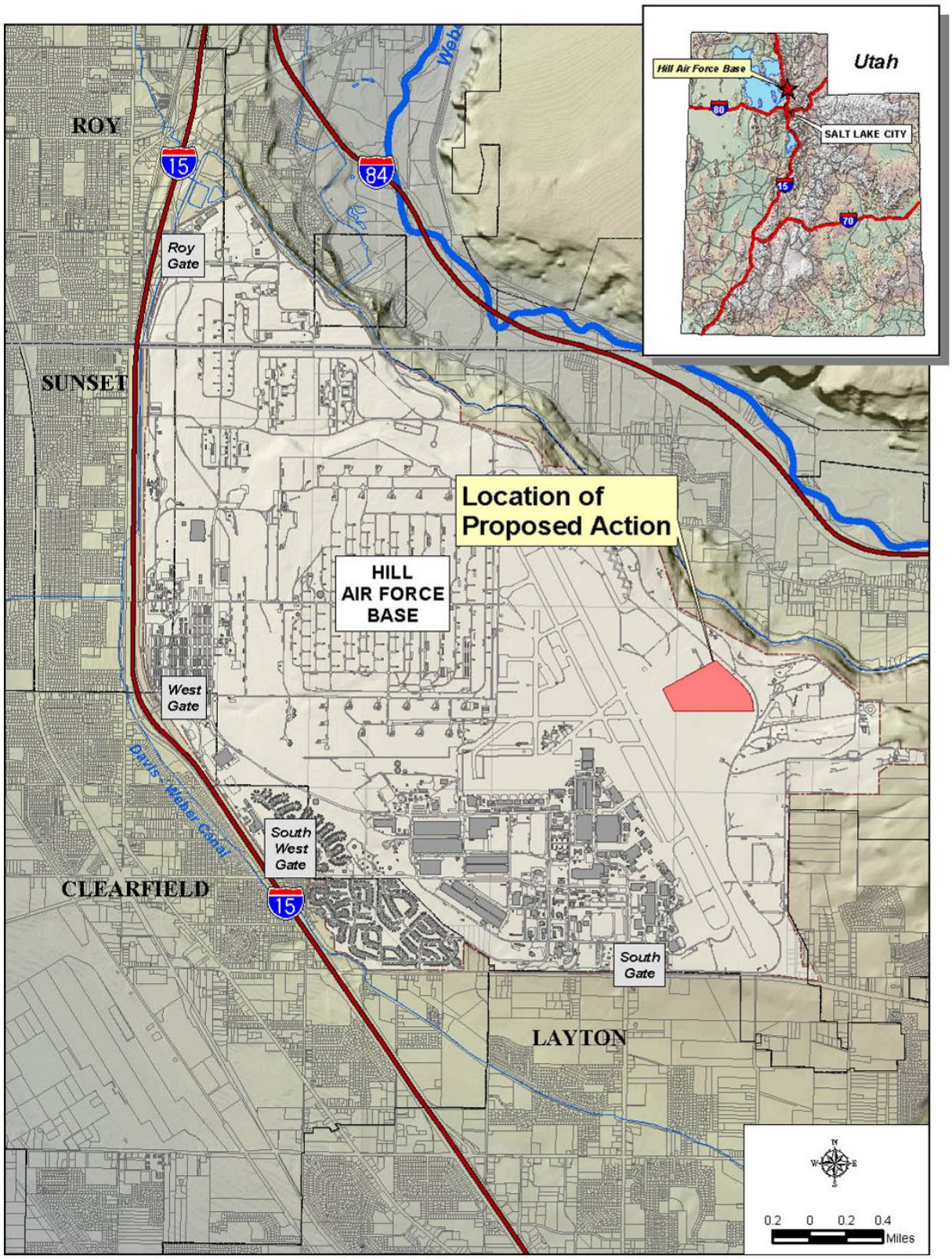

Figure 1-1. Location of the Proposed F/A-22 Facilities at Hill AFB

1.3 Regulatory History

Beginning in 1986, investigative fieldwork was conducted at Hill AFB for the Installation Restoration Program (IRP) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) efforts at the Base. As part of these efforts, nine operable units (OUs) have been designated at Hill AFB. The groundwater in the vicinity of the proposed action location east of the runway has been contaminated by dissolved chlorinated hydrocarbons that originated from OU1. The OU1 cis-dichloroethylene (DCE) contaminant groundwater plume lies below the portion of the proposed action location to the east of the runway.

1.4 Applicable Requirements

There are several regulatory environmental programs that apply to the proposed action. These program requirements are described below.

1.4.1 National Environmental Policy Act Requirements for Air Force Actions

The National Environmental Policy Act (NEPA) of 1969 requires federal agencies to analyze the potential environmental impacts of a proposed action and to evaluate reasonable alternative actions. The results of the analyses are used to make decisions or recommendations on whether and how to proceed with those actions. Title 32 of the Code of Federal Regulations, Section 989 (32 CFR 989), *The Environmental Impact Analysis Process*, describes the process of preparing an EA for proposed actions on Air Force property. Based on the EA, either a Finding of No Significant Impact (FONSI) or an Environmental Impact Statement (EIS) is prepared. This EA looks at the environmental impacts of the proposed action and the no-action alternative. Both 32 CFR 989 guidance and the implementing regulations of NEPA (40 CFR Part 1500) were followed in preparing this EA.

1.4.2 Air Quality Requirements

The Utah Air Quality Regulations, found in the *Utah Administrative Code* (UAC) R307, apply to the proposed construction and operation of the F/A-22 maintenance facilities. Hill AFB currently has a Title V Operating Permit that regulates emission factors for painting and depainting operations, jet engine testing operations, and aircraft fuel tank purge systems. In addition to other industrial processes, the Operating Permit may need to be modified to apply to any new or modified stationary source associated with the proposed action.

The proposed action would occur in a region that has been classified as a "maintenance area" for ozone. Therefore, the federal conformity requirements at 40 CFR 93.153 require a conformity determination to be completed, unless it can be shown that the increased emissions from non-stationary equipment are *de minimis* or the action is specifically exempted. Appendix A includes a screening analysis that shows that facility construction and operation activities associated with the proposed action would have potential pollutant emissions well below the appropriate *de minimis* values; therefore, no conformity determination will be required.

1.4.3 Noise Emission Requirements

Noise pollution is regulated by the Noise Control Act of 1972 (NCA). The NCA requires federal facilities to implement measures to reduce noise emissions. Generally, federal agencies whose activities result in increased environmental noise in the surrounding community are responsible for compliance with state and local environmental noise requirements. The state of Utah has no noise control regulations, although Utah Code 10-8-16 gives cities the authority to develop noise control regulations or standards.

1.5 Scope and Organization of This Document

The remainder of this document is organized as follows:

- Section 2 provides a description of the selection criteria, the proposed action and the no-action alternative;
- Section 3 describes the existing environmental conditions at Hill AFB;
- Section 4 identifies the potential environmental consequences associated with implementing the proposed alternatives;
- Section 5 presents a list of the preparers of this report;
- Section 6 contains a list of offices, agencies, and persons contacted for information used in the report;
- Section 7 includes a list of references;
- Appendix A contains potential air emission estimates; and
- Appendix B contains a computed health risk factors for DCE contamination in the groundwater.

Section 2
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section lists the criteria for selecting reasonable alternatives. The proposed action and the alternative actions are identified, summarized, and evaluated against these criteria. Alternatives that did not meet the selection criteria were eliminated from further evaluation.

2.1 Selection Criteria

The existing facilities and open areas at Hill AFB were evaluated to determine their potential for housing the new F/A-22 maintenance hangar facilities. All F/A-22 facilities must be located adjacent to the flight line and must comply with the Force Protection requirements of AFI 31-210, *Anti-Terrorism/Force Protection*. To be considered as an acceptable alternative, the proposed location must also be of sufficient size to accommodate all the necessary workload facilities. The facilities need to be collocated for several reasons:

- to save the expense of packaging components to protect against contamination when routing through various shops between buildings for repair;
- to prevent interruption of flight line operations; and
- to save on shipping and towing costs.

In order to select the appropriate alternative to meet the purpose of the project, the following selection criteria were developed:

- The alternative must satisfactorily meet the conditions required for fulfilling the F/A-22 mission;
- The alternative must meet Force Protection requirements; and
- The alternative must support flight operations.

2.2 Formulation of Alternatives

The following alternatives were considered for the new F/A-22 workload facilities:

No Action Alternative

The No Action Alternative does not meet the selection criteria, however it was evaluated in this EA in accordance with NEPA requirements.

Use of Existing Facilities at Hill AFB

Currently there is no repair hangar at Hill AFB suitable to handle the entire planned composite aircraft workload. Hangars used to support existing maintenance, fuel/defuel, paint/depaint, and flight testing operations are spread throughout the west side of the flight line and are being fully utilized to repair existing aircraft. As there are no suitable facilities currently available, this alternative was eliminated from further consideration.

Construction of New Facilities on the East Side of the Flight Line

No existing space is available on the west side of the flight line large enough to accommodate the new F/A-22 mission. The east side of the runway is the only area on base that is adjacent to the flight line (supporting flight operations), meets Force Protection requirements, and has enough land to accommodate all the proposed F/A-22 complex facilities. The proposed action consists of constructing the required F/A-22 maintenance repair facilities on the east side of the main runway, south of the C-130 hangars.

The No Action Alternative and the Proposed Action Alternative are described in the following sections.

2.3 No-Action Alternative

Under the no-action alternative, the proposed F/A-22 maintenance and repair facilities would not be constructed at Hill AFB. The F/A-22 workload would take place at a contractor facility or at another Air Force Base. Under the Source of Repair Assignment Process (SORAP), the government has determined that Hill AFB is the location that provides the best value for performing this workload. Therefore, under the No Action Alternative, the government would incur additional costs to perform this work.

2.4 Proposed Action: Construction and Operation of a New F/A-22 Fueled Composite Overhaul/Test Facility

It is expected that the F/A-22 workload will employ between 400 and 600 personnel and must be able to accommodate up to 54 aircraft per year. To handle the new workload, Hill AFB is proposing to construct a 270,000 square feet composite repair hanger on the east side of the main runway, south of the C-130 hangars. The medium bay maintenance hangar with be constructed with concrete foundation, floor slab, structural steel frame, insulated walls, roof, and hangar doors. The facility will include a Radar Cross Section (RCS) test cell, paint/depaint docks, fuel/defuel docks, flight test docks, an engine staging building, a seat and canopy staging building, airfield pavements, truck access and automotive parking pavement, restrooms, break area, and administrative offices. Once constructed, overhaul and repair activities at the facilities will include the disassembly, cleaning, inspecting, and reassembly. The workload will also include parts repairs on an as-required basis.

An adjacent Engine Test Cell Hush House will be constructed with a concrete pad and access pavements to perform operational checkout of F/A-22 aircraft including measuring engine thrust performance. All engine test runs will be conducted in the hush house. Each run-up will last up to two hours and each of the two engines may be tested separately or together. The hush house environmental impacts are being addressed in a separate EA and are not included in this report.

The paint stripping operations will be performed with hand sanding or abrasive media blasting, rather than solvent stripping. There are no plans to install vapor control equipment in the paint hangar, however, particulate matter control filters will be used. Water from the plane washing operations will be routed to the Base's Industrial Wastewater Treatment Plant (IWTP) by way of pumping/truck and/or existing drainage lines.

The fuel tank capacity of the F/A-22 aircraft is about 2,800 gallons. A new dock will be constructed to accommodate the fueling/defueling facilities. Purged fuel will be put into tanker trucks or above ground storage tanks and reused after distilling at the existing purging facility on Base. After maintenance operations are complete, aircraft will be refueled from tanker trucks or later from above-ground storage tanks.

Associated with hangar operations, but to be constructed at a later date, is a new fire station, which is necessary to meet the required five-minute incident response time to the F/A-22 facilities and to support the Base's east area infrastructure. The fire station will have access to the flight line and facilities associated with the maintenance hangar. Without a fire station on the east side of the runway, the safety and protection of the high value F/A-22 assets would be compromised. The station will be constructed with a 10-year projected growth in mind (National Fire Protection Agency requirement) and large enough to house the dispatch center and serve as an alternate location for the Base's Emergency Operation Center. The station will be approximately 2,400 square feet, with three bays and living quarters for the 7 full time staff stationed there. There will be two trucks and two hazardous material trailers garaged at the station. One of the three bays will be large enough to house a P-23 "crash" truck. The P-23 runs into the midst of an incident (downed aircraft, for example), dousing flames. The personnel and equipment to be stationed at the new station would not be new; rather existing fire protection staff and equipment on Base would be redistributed to the new station.

An existing elevated radar dome housing the FPS-117 Radar System is located near the proposed F/A-22 hangar site and would not be able to function properly if the F/A-22 facility is built. The FPS-117 radar system is used for all validation, analysis, and testing of hardware and software modification for the early warning network of FPS-117 radars. Construction of the new F/A-22 facility would block the required line of site to Salt Lake International Airport and interfere with the radar's ability to use the Salt Lake air traffic to ensure that the upgrades it receives or develops and tests will actually work as intended. As the new F/A-22 facilities may interfere with existing radar operations, the existing FPS-117 radar transmitter/receiver must be relocated to provide a clear view of air traffic at Salt Lake International Airport. Therefore, the proposed action includes constructing a new radar tower either: 1) to one side of the existing radar tower and elevating it to 105' high in order to see over the hangar; or 2) in the golf course area. If constructed near the golf course, the existing tower would be of sufficient height and a new tower would not be required.

The facilities associated with the proposed action, including the F/A-22 maintenance hangar, the hush house, the fire station, and the FPS-117 tower relocation, are shown in Figure 2-1.

Figure 2-1. Proposed Action Facilities

Section 3
DESCRIPTION OF EXISTING ENVIRONMENT

This section describes the existing environmental conditions near the proposed action location.

3.1 Surface Water

There are no streams or rivers located within the boundaries of Hill AFB. The Davis-Weber Canal, a privately owned irrigation canal is located approximately 0.5 miles northeast of Taxiway Delta. The canal typically contains water from April to October, and follows the boundary of the Base. The nearest surface water is a wetlands area located about 0.25 miles east of the proposed action location.

3.2 Groundwater

Hill AFB is part of the Weber Delta subdistrict. Water can be obtained from two main aquifers, the Sunset and the Delta, which occur approximately 250 to 400 feet and 500 to 700 feet below the ground surface, respectively (Montgomery Watson, 1998). Perched water tables, which occur in clay layers at shallow depths, slow down the downward movement of water, causing the water to pool or move close to the surface. Consequently, perched water tables should not be carelessly changed or eliminated (U.S. Air Force, 1989). Recharge to the shallow aquifers occurs by seepage from streams and canals, and by infiltration from precipitation and irrigation.

Groundwater in the vicinity of the proposed repair hangar has been contaminated by dissolved chlorinated hydrocarbons that originated from OU1. Groundwater beneath the proposed hangar and flight test operations area is part of the OU1 contaminant plume. The Contaminants of concern in the OU1 groundwater plume include trichloroethene (TCE), perchloroethylene (PCE), and DCE. However, the only contaminant detectable below the surface of the proposed sites is DCE, which ranges up to 70 micrograms/liter (μg/l) (CH2MHILL, 2001).

3.3 Geology and Soils

Geology

Hill AFB, at an elevation of 4,600 to 4,850 feet above sea level, is located in the southwest part of the Weber Delta District, which encompasses approximately 40 square miles in Weber and Davis Counties. It is the largest of the Pleistocene deltas associated with Prehistoric Lake Bonneville (U.S. Air Force, 1989). The Weber Delta formed as mountain waters flowed into the lake. The Provo formation is the formation found over 90 % of Hill AFB and consists of gravel and sand.

Soils

Surface soils are composed primarily of sand, gravel, silts, and clays typical of the Weber Delta district. The soils are mostly well-drained (moderate to extreme permeability) and have a slight to moderate erosion susceptibility. The surface layers are 7 to 17 inches thick and are generally alkaline, with an average pH of 7.8. Silty-sand is present to approximately 600 feet deep, with some isolated clay layers 5 to 30 feet below the surface (U.S. Air Force, 1989). There is no known soil contamination in the vicinity of the proposed action location.

3.4 Vegetation

Hill AFB vegetation is dominated by Big Sagebrush and various grasses, a category known as the Sagebrush Zone (U.S. Air Force, 1989). The well-drained soils on Base make the vegetative climate drier than expected.

The site of the proposed action is an undeveloped area on the east side of the runway. Any vegetation located in this area is mowed frequently as a vegetation, fire, and pest control measure. Crested wheatgrass, which does not generally attract insects and is an effective erosion control cover, is the primary vegetation planted near the flightline. There are no known resident federal threatened or endangered vegetative species on the Base (Hill AFB, 2001)

3.5 Wetlands

The proposed actions do not involve sites on or adjacent to any wetland areas.

3.6 Air Quality

The site and sources of regulated pollutants associated with the proposed actions are located in Davis County, which is designated by the U.S. Environmental Protection Agency (EPA) as a maintenance area for ozone and an attainment area for all other National Ambient Air Quality Standards (NAAQS). Air pollutant emission sources at Hill AFB include aircraft operations and maintenance, vehicular activities, and various industrial activities. Emissions from these sources include particulate matter smaller than ten microns (PM_{10}), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), carbon monoxide (CO), and hazardous air pollutants (HAPs).

The *Utah Administrative Code* Rule 307 (UAC R307) requires stationary sources of regulated air pollutants to operate under a Title V Operating Permit issued by the Utah Division of Air Quality (UDAQ). Title V stipulates conditions necessary for a stationary source to achieve compliance with state and federal air quality regulations. In addition, the Title V Operating Permit provides a means of achieving compliance with the NAAQS.

3.7 Wildlife

Sixty two species of mammals may occur on Hill AFB and associated lands (Hill AFB web site). There are no known resident federal threatened or endangered species on the Base (Hill AFB, 2001) and no animals on base classified as “declining” or “limited”. Two endangered species, the peregrine falcon and the bald eagle, hunt rabbits and rodents on and near the Base. The area of the proposed action location is undeveloped and mowed frequently. Due to potential vehicle and aircraft hazards, the Base does not attempt to attract wildlife.

3.8 Archaeological and Historical Resources

No archeological resources have been identified on or near the area of the proposed action. According to the Hill AFB Integrated Cultural Resource Management Plan (Hill AFB, 2005), there is an extremely low potential for undisturbed archaeological deposits of significance on Hill AFB proper.

3.9 Land Use

The proposed F/A-22 facilities will be located on the east side of the runway, in a currently undeveloped area. This area is currently designated as open space and has been designated for future aircraft maintenance and operations (Hill AFB, 1989). It has been classified in the Hill AFB Integrated Natural Resources Management Plan (Hill AFB, 2001) as semi-improved land. Semi-improved lands are lands where periodic maintenance is performed for operational and aesthetic reasons. These usually include grounds adjacent to runways, taxiways, aprons, runway clear zones, lateral safety zones, rifle and pistol ranges, picnic areas, ammunition storage areas, antenna facilities, and similar areas.

3.10 Noise

Primary sources of noise at Hill AFB include aircraft operations and vehicle traffic. Aircraft stationed at Hill AFB include the F-16. There are also various transient aircraft that may undergo depot maintenance. Sources of aircraft noise associated with the maintenance operations include flights and engine testing.

Typical flight patterns at the facility include aircraft landings, departures, and touch-and-go patterns. The facility's runway is 13,529 feet long. It is oriented northwest to southeast and is located in the southeastern corner of the installation.

Noise from surface traffic is generated by approximately 60,000 vehicle trips per day generated by employees and staff members who work at the Base. This number of vehicle trips is based on the approximately 20,000 employees and staff members at the Base, and a nominal trip generation factor of three trips per day per employee.

Housing areas are the primary noise-sensitive land uses on the base. The largest housing area is located in the southwestern corner of the Base. Additional, smaller housing areas are located on the western and southern sides of the Base. There are no housing areas located in the vicinity of the proposed action. Off-Base adjacent land uses include residential, agricultural, commercial, and industrial uses. Noise-sensitive residential uses are located north, northeast, east, south, and southwest of the Base.

3.11 Health and Safety

Safety at Hill AFB is administered through the Ogden Air Logistics Safety Office, which has four divisions: Weapons Safety, Flight Safety, Ground Safety, and Systems Safety. The health of personnel at Hill AFB is under Bioenvironmental Engineering Services. Bioenvironmental Services complete surveys which examine tasks, materials, processes, and procedures that may expose personnel to potential health hazards. There are no known health and safety issues associated with the proposed action location.

3.12 Transportation

Currently, the transportation needs of the Base are being met by the existing infrastructure and roadways. Although, congestion is a problem during the morning and late afternoon commute times, parking in industrial areas, such as the areas of the proposed actions, is adequate for existing personnel.

3.13 Socioeconomics

Hill AFB, located in both Davis and Weber Counties, employs approximately 23,000 people (Hill AFB web site). The 2000 combined population of Davis and Weber Counties was approximately 435,500 (2000 U.S. Census Data). Consequently, Hill AFB represents a major employer in the two-county area.

Section 4
ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

This section evaluates the potential environmental impacts of the proposed action and the no-action alternative of the F/A-22 Hangar and RCS facility (collectively considered as the hangar, unless specifically called out otherwise) at Hill AFB.

4.1 Surface Water

Proposed Action
The proposed action poses no predictable long-term impacts to surface water. Purging and defueling will occur adjacent to the F/A-22 maintenance hangar. Spill containment within the defueling bay will provide protection against fuel spills and contaminated storm water runoff. Long-term impacts due to increased storm water runoff from parking lots and pavement could be mitigated by installing sediment basins or skimmers, or by designing drainage to run onto grass-covered soils.

Short-term impacts could occur to surface water due to construction and associated ground- disturbing activities, which would increase the potential for runoff and sedimentation in local storm water retention ponds. These impacts would cease on completion of construction activities. Standard construction practices that could be implemented to minimize potential short-term impacts are as follows:

- Minimize the size of the disturbed area associated with the construction site;
- Stockpile all excavated soils;
- Protect stockpiles from wind and water erosion;
- Replace or remove stockpiles when construction is complete;
- Stabilize construction entrances with filter fabric and large stones to reduce off-site tracking; and
- Re-vegetate disturbed areas where possible.

All process wastewater, particularly from the washing operations of the maintenance hangar, will be sent to the Hill AFB Industrial Wastewater Treatment Plant (IWTP) by either truck and/or existing drainage lines. A silver recovery system associated with x-ray film development in the RCS facility will be maintained and operated in accordance with Air Force Manual 23-110, Volume 6, Chapter 4 *Precious Metals Recovery Program*. Wastewater from the silver recovery system will also be sent to the IWTP. Silver concentrations in the silver recovery system effluent would be less than 5 parts per million (ppm). All sanitary wastewater from the hangar and the RCS facility will be sent to the sanitary sewer system. Water will be supplied to the FPS-117 radar site and the fire station only for fire suppression and potable uses by personnel occupying the sites. Sanitary wastewater from these sites will also be sent to the sanitary sewer system.

No-Action Alternative
The no-action alternative would not result in any impacts to surface water in the area.

4.2 Groundwater

Proposed Action
The proposed action poses no predictable impacts to groundwater. Although wastewater generation will increase as a result of the F/A-22 maintenance hangar, RCS facility, and fire station, existing facilities at the IWTP can manage the increased volume, and there is no threat of contaminated water entering the groundwater sources. The new hangar will include the necessary containment structures to prevent wastewater from reaching groundwater sources.

The groundwater beneath the maintenance hangar is contaminated and currently being managed and investigated as part of OU1. The contaminated groundwater beneath the subject property will not be used for drinking water or process water, and no impacts to groundwater resources from the proposed action are expected. The depth to groundwater is greater than 20 feet, which is at a depth that exceeds typical excavation activities required for structures without basements. Precautions should be taken to avoid contact with groundwater while installing plumbing and other utility lines needed for the proposed structures.

No-Action Alternative
The no-action alternative would result in no impacts to groundwater in the area.

4.3 Geology and Soils

Proposed Action
Impacts on soils in the area due to the proposed action would be limited to construction activities, including ground disturbance in undeveloped areas east of the runway. These activities would increase the potential for soil to be carried away with surface water runoff. The standard construction practices outlined in Section 4.1 would be implemented to minimize soil erosion.

No-Action Alternative
The no-action alternative would not result in any impacts to geology and soils in the area.

4.4 Vegetation

Proposed Action
The proposed construction of a repair hangar, RCS facility, and associated paved areas would result in the disturbance of up to 25 acres of undeveloped grassland. The remaining proposed construction areas (radar tower and fire station) are located within developed areas and would not impact vegetation. No known endangered or threatened plant species exist in the proposed areas of construction. Therefore, the long-term impacts of the proposed actions on vegetation would not be significant.

No-Action Alternative
The no-action alternative would not result in any impacts to vegetation in the area.

4.5 Wetlands

Proposed Action
The proposed action does not involve sites on or adjacent to any wetland areas. Therefore, no adverse environmental impacts to wetlands are expected.

No-Action Alternative
The no-action alternative would have no impact on wetlands.

4.6 Air Quality

This section provides a description of the air emission sources and anticipated air quality impacts from the proposed action. Emission estimates are based on historic data taken from the emission inventory for Hill AFB and other data supplied by Hill AFB personnel. Based on the estimated emissions, no significant short-term or long-term impacts to local or regional air quality conditions are expected to occur as a result of either the proposed action or the no-action alternative.

4.6.1 Proposed Action

The emission sources resulting from the construction and operation of the F/A-22 maintenance building and associated facilities would include the following:

- Construction Equipment;
- Aerospace Ground Equipment (AGE);
- Defueling/Fuel Tank Purging;
- Abrasive Blasting;
- Aircraft Painting/Corrosion Control;
- Aircraft Operations;
- Solvent Degreasing Operations; and
- Jet Engine Testing.

In addition, mobile source emissions may increase as a result of increased vehicle miles traveled due to the increased number of employees associated with the new workload.

Emissions associated with the above categories, except jet engine testing, are described below. Appendix A contains the emission calculations. Annual emissions from jet engine testing will be addressed in a separate EA.

4.6.1.1 Construction Equipment

Construction activities associated with building the new facilities for the proposed action would result in some short-term emissions of regulated pollutants. Total emissions generated by construction equipment associated with the proposed hangar would result in approximately 2.9 tons of CO, 1.0 ton of VOC, 12.4 tons of NO_x, 1.1 tons of SO_x, and 0.8 tons of PM_{10}. Additional emissions would result from construction of the fire station and the relocation of the radar tower. Emissions from these activities would be minimal compared to hangar construction.

Construction activities would also result in some short-term fugitive dust emissions. The Base's "Main Base Fugitive Dust Control Plan" requires implementing control measures for construction activities on land areas over one-quarter acre or greater in size. The control measures include, but are not limited to, the following:

- Planting vegetative cover;
- Watering and/or chemical stabilization; and

- Close monitoring of construction activities with a watering truck present to minimize fugitive dust.

Fugitive dust emissions would be kept to a minimum by implementing the above measures during construction as needed.

4.6.1.2 Aerospace Ground Equipment (AGE)

The additional F/A-22 aircraft included in the proposed actions would require additional operating time of existing AGE. However, constructing the indoor flight test area would reduce the AGE requirement for outdoor flight testing. Consequently, the emissions increase as a result of the proposed action from AGE would be negligible. Since no new AGE is expected, the Title V permit should not require updating in this area. The emissions of AGE will be reported as usual in the annual emissions inventory.

4.6.1.3 Defueling/Fuel Tank Purging

The fuel tank purging and jet fuel recovery operations at the new hangar are addressed under the Title V Operating Permit (Conditions on Aircraft Fuel/Oil Purge System), which currently limits total fuel recovery to 60,000 gallons per 12-month period. However, Hill AFB is currently in the process of requesting this limit to be increased to 120,000 gallons per 12-month period.

The F/A-22 fuel tank holds approximately 2,800 gallons of JP-8. All of the fuel remaining in the tank must be emptied before maintenance operations can occur. In 2006, seven F/A-22s will be maintained at the proposed hangar. Assuming 2,000 gallons of JP-8 fuel is removed per F/A-22 then 14,000 gallons of fuel will be removed that year. By 2012, the expected number of F/A-22s will increase to 54, which would require approximately 108,000 gallons of JP-8 fuel to be removed. Modification of the Operating Permit will have to be considered as the number of F/A-22s maintained in the new hangar increases. Based on the emission factor of emission factor of 0.01 lb VOC/lb JP-8 reclaimed, at full capacity, the F/A-22 workload would contribute 3.3 tons of VOC emissions per year.

4.6.1.4 Abrasive Blasting

Abrasive blasting for depainting the F/A 22 aircraft would occur in the proposed painting/depainting docks. Both hand-sanding and plastic media blasting will be performed on the aircraft. PM_{10} emissions from these operations are estimated at less than 0.1 tons per year. The proposed blasting booths will be equipped with dust collector systems to reduce PM_{10} emissions. In addition, UAC R307-206, "Emission Standards, Abrasive Blasting", establishes opacity limits for abrasive blasting. Consequently, PM_{10} emissions from the proposed operations would be minimal, and would not pose a significant impact.

4.6.1.5 Aircraft Painting

The painting operations proposed for the additional F/A-22 workload are addressed under the Title V Operating Permit (Conditions on Aerospace NESHAP Coating). Each primer or topcoat applied to the aircraft must meet the applicable requirements specified in the Title V Operating Permit.

Emissions associated with the surface coating of the proposed F/A 22 workload are based on the quantities used for the C-130 workload included in the C-130 Complex EA (Radian, 1999). The painting materials include a topcoat, heat resistant paint, primer, and other various solvents and sealers. The VOC emissions for the F/A 22 workload were estimated by multiplying the C-130 VOC emissions per aircraft times the ratio of the F/A 22 surface area (2,200 square feet per aircraft) to the C-130 surface area (11,800 square feet per aircraft). Surface coating of 54 F/A 22 aircraft would result in approximately 3.14 tons per year of VOC and a negligible amount of hazardous air pollutants.

4.6.1.6 Aircraft Operations

The addition of the F/A-22 workload would result in increased aircraft activity and associated emissions at the Base. In addition to the initial delivery and departure flight, each aircraft will undergo an average of 1.5 additional check flights, which represents approximately 135 additional take-offs and landings per year from 54 F/A-22s. Approximately 81,000 air-field operations were performed throughout 2004 from all aircraft associated with Base operations. Therefore, any additional emissions from the F/A-22 workload would be considered negligible.

4.6.1.7 Solvent Degreasing Operations

VOC emissions resulting from solvent use associated with surface coating of the aircraft are included in the painting VOC estimate. Minimal amounts of isopropyl alcohol, which has a VOC content of 6 lb/gal, will be used at the RCS facility to wipe down equipment. Consequently, other than those estimated with painting operations, emissions from solvent use associated with the proposed workload would be considered negligible.

4.6.1.8 Conformity Analysis

The new emissions of VOC and NO_x associated with the proposed action are well below the conformity threshold of 100 tons per pollutant per year. VOC emissions would total approximately 10 tons per year, and NO_x emissions would total approximately 20 tons per year. As a result, Hill AFB is not required to prepare a full conformity determination and additional analysis to prove that the proposed federal action would not exceed regional planning levels of non-attainment pollutants.

4.6.2 No-Action Alternative

The no-action alternative will have no adverse impact on air quality conditions at Hill AFB.

4.7 Wildlife

Proposed Action

The areas under consideration for the new facilities support species that are common in undeveloped locations at Hill AFB (e.g. birds and small mammals) and do not provide important wildlife habitat. During construction activities, affected species would move to other locations in the vicinity of the corridor. In addition, as no sensitive or threatened and endangered species are located in the area, no significant adverse impacts to wildlife are expected from the proposed action.

No-Action Alternative

The no-action alternative would have no impact on wildlife.

4.8 Cultural Resources

Proposed Action

No known cultural resources exist near the proposed action sites. If any significant cultural resources are observed during construction, work in the immediate vicinity would stop, and the Hill AFB cultural resources manager would implement inadvertent discovery procedures in accordance with the Hill AFB *Integrated Cultural Resources Management Plan*.

No-Action Alternative

The no-action alternative would have no impacts on cultural resources.

4.9 Land Use

Proposed Action
No significant impact is expected on existing land use. The new hangar facilities will be constructed to accommodate maintenance on the F/A-22 fighters. The construction would occur in the airfield buffer zone, which cannot be utilized for purposes other than those related to aircraft operations. Therefore, further development of the F/A-22 maintenance hangar and associated facilities does not change the area designation or adversely impact the land use at Hill AFB.

The fire station will be constructed north of the maintenance hangar outside the airfield buffer zone on developed land. No adverse impact is expected since the area is currently developed. The FPS-117 radar system dome will be relocated either to an area that is adjacent to its current location or to the golf course area. Both locations are already developed and no modifications to current land use would be required.

No-Action Alternative
The no-action alternative would not result in any adverse impacts to land use in the area.

4.10 Noise

Potential noise impacts associated with implementing the proposed action have been evaluated by comparing anticipated noise conditions that would result from the proposed action with existing conditions or with noise compatibility criteria used by the Air Force.

Adverse noise impacts are considered to occur if implementing the proposed action would:

- Expose noise-sensitive land uses to substantial increases in noise; or
- Expose noise-sensitive land uses to noise in excess of planning guidelines relating to noise.

4.10.1 Proposed Action

Construction of new facilities to accommodate the additional F/A-22 operations would be a source of noise. Depending on the stage of construction, construction equipment operations can vary from intermittent to fairly continuous, with multiple pieces of equipment operating concurrently. These activities will cause an increase in noise. However, construction will be short term and would be conducted during daylight hours. There are no noise-sensitive receptors in the vicinity of the proposed action; therefore no significant adverse noise impacts are expected.

Implementing the proposed action would result in the addition of employees or staff members to support the additional F/A-22 operations. Accordingly, an increase in the number of daily vehicle trips and traffic noise associated with vehicle trips is anticipated. The proposed action is therefore anticipated to result in additional surface traffic noise; however these impacts are not expected to be significant.

The F/A-22 workload would add up to 135 aircraft take-offs and landings per year, assuming 1.5 flight checks per aircraft (each with a take-off and landing), initial arrivals, and final departures. This would be a negligible increase compared to 81,000 air field operations, which include take-offs and landings per year at the Base. Therefore, the noise impacts associated with this workload are not considered significant. As mentioned previously, noise impacts from the hush house associated with the F/A-22 workload jet engine testing are addressed in a separate EA.

4.10.2 No-Action Alternative

Under the no-action alternative, no construction would occur, no increase in traffic would occur, and no new aircraft would be added to current operations. Accordingly, no adverse noise impacts would occur.

4.11 Health and Safety

Proposed Action
The construction of new facilities associated with the proposed actions would result in short-term construction-related health and safety concerns. Standard construction safety precautions would be taken, including proper personal protective equipment, barricades, and necessary safety meetings and instructions.

Potential health risks associated with DCE volatilization from the OU-1 contaminant plume into the hangar were calculated using conservative assumptions. These calculations, detailed in Appendix B, show there are no health concerns associated with volatilization of DCE from the contaminated groundwater.

An Air Force Bioenvironmental Engineering survey examines tasks, materials, processes, and procedures that may expose personnel to potential health hazards. Based on a Bioenvironmental Engineering survey report conducted for a similar RCS facility at Hill AFB, workers in the potential exposure group (PEG) of the proposed RCS facility will conduct x-ray operations, perform ultrasound eddy current testing, and use penetrant dyes to inspect various parts for defects.

Provided the required controls are in place, there are no anticipated health and safety concerns associated with operation of the proposed RCS facility. These controls include:

- ear plugs for noise levels from the shearography vacuum and shearography laser areas;
- facility shielding, warning signs, rotating red lights, interlocks, interior alarms, monitoring instruments, digital audio dosimeters, thermo luminescent dosimeters, and written operating instructions for the x-ray operations and equipment; and
- interlocked enclosures, safety training, and appropriate labeling on laser units.

An environmental assessment was conducted when the FPS-117 radar system was moved to Hill AFB as a result of the Base Realignment and Closure (BRAC) decision to close McClellan Air Force Base. As part of that EA (Hill AFB, 1999), a team of Bioenvironmental Engineering technicians determined that no personnel overexposures to radio frequency (RF) radiation would occur from normal operation of the FPS-117 radar at Hill AFB. The highest power density measured during the survey was 0.48 megawatts per square centimeter (MW/cm^2), which is below the 0.8 MW/cm^2 and 4 MW/cm^2 permissible exposure limits established by Air Force Occupational Safety and Health (AFOSH) Standard 48-9. Relocating the FPS-117 radar as part of the proposed action would not affect the radar operations or power density emitted. Therefore, the proposed action is not expected to pose a radiation health concern to Hill personnel.

No-Action Alternative
The no-action alternative would result in no health and safety concerns.

4.12 Transportation

Proposed Action
The proposed action would result in additional employee traffic, both vehicular and pedestrian, to the currently congested Base conditions. The addition of 400 to 600 employees to the traffic system at Hill AFB could have an additional detrimental effect on the commuter and parking problems on Base. However, parking will not be affected since an additional parking lot will be constructed northeast of the

maintenance hangar. Traffic congestion on Base could be mitigated by staggering work hours or providing shuttle service if problems were severe enough.

No-Action Alternative
The no-action alternative would not result in any impacts to traffic on-Base.

4.13 Socioeconomics

Proposed Action
The proposed action is expected to employ between 400 and 600 new people. These jobs would generally require skilled laborers and post-secondary educated individuals with technical skills related to aviation, and mechanical equipment repair.

With the changing global environment and associated reduction in military forces, the long term future of Hill AFB is uncertain; however, an increase in workload opportunities at Hill AFB could have a positive effect on the local economy. Increased workload at Hill AFB would result in several new jobs for semi-skilled and skilled workers, which would result in increased housing demand and retail sales in the area.

No-Action Alternative
The no-action alternative will not increase the number of employees at Hill AFB, and it will not prohibit downsizing of the Base.

4.14 Environmental Justice
Environmental justice analyses for NEPA documents attempt to determine whether a proposed action disproportionately impacts minority and poor populations. However, because the Base is not located adjacent to such groups, and because the proposed action does not result in significant adverse impacts, no environmental justice impacts are expected.

4.15 Cumulative Impacts
The impacts from the proposed A/F-22 workload increase are summarized in Table 4-1. The proposed action, in conjunction with the current aircraft operations at the Base, is not expected to have any significant adverse impacts on the environment. The additional air emissions will not cause any violations of the Base's Operating Permit or any exceedences of local or regional air quality standards. In addition, noise levels are not expected to increase over existing aircraft noise levels. All other impacts are associated with construction activities and are expected to be short-term.

The no-action alternative would not result in a significant adverse environmental impact. However, if downsizing were to occur at Hill AFB, the impact on the local economy would be significant. Both Davis and Weber Counties rely heavily on Hill AFB for employment and associated economic benefits.

Table 4-1. Anticipated Environmental Consequences

Environmental Issues	Impacts from Proposed Action	Impacts from No-Action Alternative
Surface Water	Potential short-term increase in erosion and sediment runoff in the storm water drainage system from ground-disturbing activities. No long-term impacts.	No impact.
Groundwater	No adverse impacts.	No impact.
Geology and Soils	Potential short-term increase in erosion and sediment runoff from ground-disturbing activities. Approximately 25 acres of disturbed land is expected. No significant adverse impacts.	No impact.
Vegetation	Minor impact associated with construction activities on currently undeveloped grassy areas. Approximately 25 acres of disturbed area is expected. No significant adverse impacts.	No impact.
Wetlands	No adverse impacts.	No impact.
Air Quality	Short-term fugitive emissions during construction activities. No significant adverse impacts.	No impact.
Wildlife	No significant adverse impacts.	No impact.
Cultural Resources	No anticipated impact. Ground-disturbing activities will be monitored for artifacts; work will stop if any found.	No impact.
Land Use	New hangars would be constructed in undeveloped areas near the runway in the airfield buffer zone and in aircraft operations and maintenance areas. No adverse impacts.	No impact.
Noise	No significant adverse impacts.	No impact.
Health and Safety	Short-term hazards associated with construction activities. No significant adverse impacts provided appropriate worker safety controls are in place.	No impact.
Transportation	An increase in vehicles is expected from the workload associated with the maintenance hangar. No significant adverse impacts.	No impact.
Socioeconomics	No adverse impact. Beneficial impacts include the creation of 400 to 600 new jobs at the Base.	No impact.
Environmental Justice	No adverse impacts.	No impact.

Section 5
LIST OF REPORT PREPARERS

Kay Winn, NEPA Program Manager, Hill Air Force Base, Utah.

Mary DeLoretto, Senior Project Engineer, URS Corporation, Salt Lake City, Utah.

John Peterson, Staff Engineer, URS Corporation, Salt Lake City, Utah

Alex Hildebrand, Environmental Scientist, URS Corporation, Salt Lake City, Utah.

Patti Garver, Senior Engineer, URS Corporation, Salt Lake City, Utah.

Section 6
LIST OF PERSONS CONTACTED

Dave Gange, Facilities Engineer, Hill AFB, 801-777-6363, regarding F/A-22 facility improvements.

Jaynie Hirschi, Archaeologist, Hill AFB, 801-775-6920, regarding cultural resources.

Glen Palmer, Hill AFB, 801-775-6918, regarding air quality issues.

Gary Peterson, 801-777-1906, regarding the FPS-117 radar.

Guy Phillips, 801-777-2048, regarding F/A-22 facility improvements.

Pat Vega, 801-586-4195, regarding the proposed fire station.

Rosemary Revels, 801-586-2150, regarding the TPS-75 radar.

Nicholas Peterson, 801-586-2494, regarding air emissions/permitting.

Brian Watson, Hill AFB Airfield Manager, 801-777-3592, regarding airfield operations.

Melissa Cary, CH2MHill, 801-775-6989, regarding painting emissions.

Sanford Moss, Hill AFB, 801-775-6972, regarding natural resources.

Ken Bakes, Civil Engineering Hill AFB, 801-586-8427, regarding NDI facility improvements.

Section 7
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APPENDIX A

Air Emissions

VOC Emissions from Surface Coating of F/A 22 Aircraft

Used paint data for C-130's to estimate emissions associated with F/A 22 painting; used ratio of F/A 22 surface area to C-130 surface times C-130 painting VOC esimate to estimate F/A 22 painting emissions.

Total VOC for 35 C-130's* =	10.92	tons/yr
*From C-130 EA (June 1999) includes solvent use.		
VOC per C-130 = 10.92 tons/yr/35 aircraft =	0.312	tons/yr

Surface area of C-130 =	11,800	sq. ft./aircraft
Surface area of F/A 22 =	2,200	sq. ft./aircraft

VOC per F/A 22 = 0.312 tons/yr*(2200 sq. ft/ aircraft/11800 sq. ft/aircraft) =	0.058	tons/yr/aircraft
Total VOC for 54 F/A 22 = 54 aircraft * 0.058 tons/yr/aircraft =	3.14	tons/yr

F/A 22 Emission Estimate for Abrasive Blasting

Sand Blasting

Based on an Air Force Memo dated August 10, 1995 from John Vidic,
PM_{10} emissions from scuff sanding are as follows:

PM_{10} (lb/yr) = (0.5*)*(aircraft surface area, ft^2)*(paint thickness, mil)*
(1 ft/12,000 mil)*(paint density, lb/ft^3)*(1-(% capture efficiency/100))

* Assume: PM_{10} = 0.5*TSP and capture efficiency is 95%

PM_{10} per F/A 22 = 0.5*(2,200 ft^2/F/A 22)*(2 mil)*(1 ft/12,000 mil)*(62.39lb/ft^3)*(1-(95/100))
= 0.57 lb/F/A 22
Total PM_{10} = (0.57 lbs of PM_{10} /F/A 22) * (54 F/A 22's)*(1 ton/2000 lb)
= **0.02 tons/yr**

Plastic Media

Based on historical data, assume 0.6 ton of media per F/A 22
PM_{10} Emission Factor = 2.5 lb PM_{10}/ton media (uncontrolled)

PM_{10} = (0.6 tons of media/F/A 22)*(54 F/A 22)*(2.5 lb PM_{10}/ton media)*(1 ton/2000 lb)
= 0.04 tons/yr
Assuming 95% control,
PM_{10} = (0.04 tons/yr)*(1-.95)
= **0.00 tons/yr**

Emissions from F/A 22 Aircraft Operations
Landings/Takeoffs, Approach, and Touch and Go Cycles

Number of F/A 22's	LTO cycle	Engine/aircraft
54	2.5	2

	Typical Durations for Each Engine Mode (hr/engine)				
Aircraft Type	Taxi/Idle Out	Takeoff	Climbout	Approach	Taxi/Idle In
Transport (large)	0.547	0.012	0.027	0.087	0.248

Emission Factors* T56-15 (lb/hr)	Idle taxi/idle out/in	Approach approach	Military takeoff/climbout
CO	25.6	18.4	4.8
NOx	3.1	3.7	21.3
PM	0.7	0.8	1
SOx	0.8	0.8	2.3
VOC	16.8	10.3	0.9

Emissions (ton/yr)	Taxi/Idle Out	Takeoff	Climbout	Approach	Taxi/Idle In	TOTAL
CO	1.89	0.01	0.02	0.22	0.86	2.99
NOx	0.23	0.03	0.08	0.04	0.10	0.49
PM	0.05	0.00	0.00	0.01	0.02	0.09
SOx	0.06	0.00	0.01	0.01	0.03	0.11
VOC	1.24	0.00	0.00	0.12	0.56	1.93

*All engines were assumed to be the T56-15.
Including the intial landing and takeoff, each aircraft will undergo an average of 1.5 check flights.
Each cycle includes taxi out, takeoff, climbout, approach, and taxi in.
Assumed the power settings for a full F/A 22 cycle are idle, approach, and military. Idle is used for taxi in and out, approach is used for approach, and military is used for takeoff and climbout.

An example calculation is as follows:
Engine Mode: Taxi/Idle out
Duration: 0.547 (hr/engine)
Number of L&TOs: 2.5*54 F/A 22 = 135 (F/A 22/yr)
Number of Engines: 2 (engines/F/A 22)
CO Emission Factor: 25.6 (lb/hr)
CO (tons/yr) = 25.6 (lb/hr) * 0.547 (hr/engine) * 135 (F/A 22/yr) * 2 (engines/F/A 22) * (1 ton/2000 lb)
= 1.89 tons/yr = CO emissions from taxi/idle out for all 54 F/A 22's in the proposed action.

F/A 22 Emission Estimate for JP-8 Purging

Purging of 54 F/A 22's

JP-8 VOC Emission Factor = 0.01 lb VOC/lb JP-8
Volume reclaimed for 54 F/A 22's = 108,000 gallons
JP-8 density = 6.1 lb/gal
VOC = (0.01 lb VOC/lb JP-8)*(108,000 gallons)*(6.1 lb/gallon)*(1 ton/2000 lb)
= **3.29 ton/yr**

F/A 22 Emission Estimate for JP-8 Refueling and Loading

Refueling of 54 F/A 22's
JP-8 VOC Emission Factor = 0.000913 lb/gal

VOC = (2,800 gal/F/A 22)*(54 F/A 22)*(0.000913 lb/gal)*(1 ton/2000 lb)
= **0.07 ton/yr**

Additional VOC emissions from **Loading** of additional JP-8 fuel for 54 F/A 22's
Emission Factor from AP-42, Section 5.2, Transportation and Marketing of Petroleum Liquids and 1997 HAFB Emission Inventory

VOC (tons/yr) = (0.01246)*S*VP*MW*AU*TP/T)*(1 ton/2000 lb)
S = saturation factor = 0.6
VP = true vapor pressure = 0.0085 psia for JP-8
MW = molecular weight of vapor = 130 lb/mole
AU = throughput = 54*2,800 gallons = 151,200 gallons
TP = vapor recovery fraction = 1 for all HAFB fuel racks
T = Temperature of the bulk liquid loaded (^{o}R) = 60 ^{o}F + 460 = 520 ^{o}R

VOC (ton/yr) = **0.0012 ton/yr**

Emissions associated with construction of the F/A-22 maintenance facility and the fire station

Front End Loader

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Front End Loader	160	TSP	0.172	TSP	0.17	0.01
		PM10	0.1376	PM10	0.14	0.01
		SOx	0.182	SOx	0.18	0.01
		NOx	1.89	NOx	1.89	0.15
		CO	0.572	CO	0.57	0.05
		VOC (+ald)	0.291	VOC	0.29	0.02
		aldehydes	0.041	aldehydes	0.04	0.00

Track Loader

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Track Loader	160	TSP	0.058	TSP	0.06	0.00
		PM10	0.0464	PM10	0.05	0.00
		SOx	0.076	SOx	0.08	0.01
		NOx	0.827	NOx	0.83	0.07
		CO	0.201	CO	0.20	0.02
		VOC (+ald)	0.107	VOC	0.11	0.01
		aldehydes	0.009	aldehydes	0.01	0.00

Dump Trucks

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
6 Dump Trucks	960	TSP	0.256	TSP	0.26	0.12
160 hr/truck		PM10	0.2048	PM10	0.20	0.10
		SOx	0.454	SOx	0.45	0.22
		NOx	4.166	NOx	4.17	2.00
		CO	1.794	CO	1.79	0.86
		VOC (+ald)	0.304	VOC	0.30	0.15
		aldehydes	0.112	aldehydes	0.11	0.05

Motor Grader

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Motor Grader	160	TSP	0.838	TSP	0.84	0.07
		PM10	0.6704	PM10	0.67	0.05
		SOx	0.086	SOx	0.09	0.01
		NOx	0.713	NOx	0.71	0.06
		CO	0.151	CO	0.15	0.01
		VOC (+ald)	0.052	VOC	0.05	0.00
		aldehydes	0.012	aldehydes	0.01	0.00

Concrete Trucks

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Concrete Trucks	120	TSP	0.256	TSP	0.26	0.02
15 days		PM10	0.2048	PM10	0.20	0.01
		SOx	0.454	SOx	0.45	0.03
		NOx	4.166	NOx	4.17	0.25
		CO	1.794	CO	1.79	0.11
		VOC (+ald)	0.304	VOC	0.30	0.02
		aldehydes	0.112	aldehydes	0.11	0.01

Emissions associated with construction of the F/A-22 maintenance facility and the fire station

Wheeled Dozer

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Wheeled Dozer	160	TSP	0.165	TSP	0.17	0.01
		PM10	0.132	PM10	0.13	0.01
		SOx	0.348	SOx	0.35	0.03
		NOx	4.166	NOx	4.17	0.33
		CO	1.794	CO	1.79	0.14
		VOC (+ald)	0.257	VOC	0.26	0.02
		aldehydes	0.012	aldehydes	0.01	0.00

Scissor Lift

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Scissor Lift	1733	TSP	0.139	TSP	0.14	0.12
10 months 40 hour/week		PM10	0.1112	PM10	0.11	0.10
		SOx	0.143	SOx	0.14	0.12
		NOx	1.691	NOx	1.69	1.47
		CO	0.675	CO	0.68	0.59
		VOC (+ald)	0.183	VOC	0.18	0.16
		aldehydes	0.031	aldehydes	0.03	0.03

Delivery Trucks

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
Delivery Trucks	1213	TSP	0.256	TSP	0.26	0.16
5 Trucks		PM10	0.2048	PM10	0.20	0.12
7 months of constant deliveries		SOx	0.454	SOx	0.45	0.28
		NOx	4.166	NOx	4.17	2.53
		CO	1.794	CO	1.79	1.09
		VOC (+ald)	0.304	VOC	0.30	0.18
		aldehydes	0.112	aldehydes	0.11	0.07

AP-42 Volume 2, Chapter II-7, tracktype loader, roller, off-highway truck, and miscellaneous

				Emission Factors		Emissions - Generator1			
				lb/hp-hr			lb/hr		ton/yr
Source	hp	hr/yr	hp-hr/yr	TSP	2.20E-03	TSP	1.32	TSP	0.40
Generator	600	600	360000	PM10	2.20E-03	PM10	1.32	PM10	0.40
			0	SO2	2.05E-03	SO2	1.23	SO2	0.37
				NOx	0.031	NOx	18.60	NOx	5.58
				VOC	2.51E-03	VOC	1.51	VOC	0.45
				CO	4.63E-04	CO	0.28	CO	0.08

2 Generators @ 300 hours per generator

AP-42 3.3, Table 3.3-1 (<600 hp diesel engines)

Emissions associated with construction of the F/A-22 maintenance facility and the fire station

TOTAL Emissions		
pollutant	lb/hr	ton/yr
TSP	2.14	0.91
PM10	1.71	0.81
SOx	2.20	1.07
NOx	21.79	12.43
CO	8.78	2.94
VOC	1.80	1.02
aldehydes	0.44	0.16

F/A 22 Emission Estimate for Operation of Aerospace Ground Equipment
from 54 Aircraft

AGE

		E.F.		Emissions		
	hr	pollutant	lb/hr	pollutant	lb/hr	ton/yr
AGE	2160	TSP	0.139	TSP	0.14	0.15
		PM10	0.1112	PM10	0.11	0.12
		SOx	0.143	SOx	0.14	0.15
		NOx	1.691	NOx	1.69	1.83
		CO	0.675	CO	0.68	0.73
		VOC (+ald)	0.183	VOC	0.18	0.20
		aldehydes	0.031	aldehydes	0.03	0.03

AP-42 Volume 2, Chapter II-7 miscellaneous
Assume one week (40 hours) of additional AGE operation per additional F/A 22
= 54 F/A 22 * 40 hr/F/A 22 = 2,160 hours

Total Estimated Construction and Operational Emissions for Painting and Program Depot Maintenance of F/A 22 Aircraft at Hill AFB, Utah

TOTAL EMISSIONS					
Proposed F/A 22 Complex					
Emissions tons/year					
Source Types	PM10	SO2	NOx	VOC	CO
Surface Coating	0.00	0.00	0.00	3.14	0.00
Abrasive Blasting	0.02	0.00	0.00	0.00	0.00
Aircraft Operations (LTO's, etc.)	0.09	0.11	0.49	1.93	2.99
Fuel Purging	0.00	0.00	0.00	3.29	0.00
Refueling	0.00	0.00	0.00	0.07	0.00
Fuel Loading	0.00	0.00	0.00	0.00	0.00
Construction Equipment*	0.81	1.07	12.43	1.02	2.94
Aerospace Ground Equipment	0.12	0.15	1.83	0.20	0.73
TOTAL	1.03	1.33	14.74	9.65	6.66

* Temporary emissions, during construction phase only.

APPENDIX B

Risk-Based Groundwater Concentration

The risk-based calculations are based on the Johnson and Ettinger (J and E) Vapor Intrusion Model DATA ENTRY SHEET

GW-SCREEN Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
156592	7.00E+01	cis-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	152.4	SC	10	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SC			SC	1.5	0.43	0.3

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

The risk-based calculations are based on the J and E Model CHEMICAL PROPERTIES

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	3.55E+01	3.50E+03	3.1E-06	2.1E-02

END

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
137.4	0.130	0.585	1.74E-09	0.634	1.11E-09	30.00	0.43	0.075	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
1.69E+04	1.00E+06	4.00E-04	15	7,734	2.04E-03	8.77E-02	1.75E-04	4.59E-04	9.40E-05	2.48E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
137.4	15	6.14E+03	0.10	8.33E+01	4.59E-04	4.00E+02	#NUM!	1.04E-04	6.41E-01	3.1E-06	2.1E-02

The risk-based calculations are based on the J and E Model

RESULTS

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	3.50E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
8.3E-07	2.9E-02

MESSAGE SUMMARY BELOW:

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

END

Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	n (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	0.40	0.01622	1.321	0.2430	0.481	0.111	0.0039	1.38	0.216	Silty Clay
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

Chemical Properties Lookup Table

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	URF extrapolated (X)	RfC extrapolated (X)
56235	Carbon tetrachloride	1.74E+02	7.80E-02	8.80E-06	7.93E+02	1.24E+00	3.03E-02	25	349.90	556.60	7,127	1.5E-05	0.0E+00		
57749	Chlordane	1.20E+05	1.18E-02	4.37E-06	5.60E-02	1.99E-03	4.85E-05	25	624.24	885.73	14,000	1.0E-04	7.0E-04		
58899	gamma-HCH (Lindane)	1.07E+03	1.42E-02	7.34E-06	7.30E+00	5.73E-04	1.40E-05	25	596.55	839.36	15,000	3.7E-04	1.1E-03	X	X
60297	Ethyl ether	5.73E+00	7.82E-02	8.61E-06	5.68E+04	1.35E+00	3.29E-02	25	307.50	466.74	6,338	0.0E+00	7.0E-01		X
60571	Dieldrin	2.14E+04	1.25E-02	4.74E-06	1.95E-01	6.18E-04	1.51E-05	25	613.32	842.25	17,000	4.6E-03	1.8E-04		X
67641	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03	3.87E-05	25	329.20	508.10	6,955	0.0E+00	3.5E-01		X
67663	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01	3.66E-03	25	334.32	536.40	6,988	2.3E-05	0.0E+00		
67721	Hexachloroethane	1.78E+03	2.50E-03	6.80E-06	5.00E+01	1.59E-01	3.88E-03	25	458.00	695.00	9,510	4.0E-06	3.5E-03		X
71432	Benzene	5.89E+01	8.80E-02	9.80E-06	1.79E+03	2.27E-01	5.54E-03	25	353.24	562.16	7,342	7.8E-06	0.0E+00		
71556	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.03E-01	1.72E-02	25	347.24	545.00	7,136	0.0E+00	2.2E+00		
72435	Methoxychlor	9.77E+04	1.56E-02	4.46E-06	1.00E-01	6.46E-04	1.58E-05	25	651.02	848.49	16,000	0.0E+00	1.8E-02		X
72559	DDE	4.47E+06	1.44E-02	5.87E-06	1.20E-01	8.59E-04	2.09E-05	25	636.44	860.38	15,000	9.7E-05	0.0E+00	X	
74839	Methyl bromide	1.05E+01	7.28E-02	1.21E-05	1.52E+04	2.55E-01	6.22E-03	25	276.71	467.00	5,714	0.0E+00	5.0E-03		
74873	Methyl chloride (chloromethane)	2.12E+00	1.26E-01	6.50E-06	5.33E+03	3.61E-01	8.80E-03	25	249.00	416.25	5,115	1.0E-06	9.0E-02		
74908	Hydrogen cyanide	3.80E+00	1.93E-01	2.10E-05	1.00E+06	5.44E-03	1.33E-04	25	299.00	456.70	6,676	0.0E+00	3.0E-03		
74953	Methylene bromide	1.26E+01	4.30E-02	8.44E-06	1.19E+04	3.52E-02	8.59E-04	25	370.00	583.00	7,868	0.0E+00	3.5E-02		X
75003	Chloroethane (ethyl chloride)	4.40E+00	2.71E-01	1.15E-05	5.68E+03	3.61E-01	8.80E-03	25	285.30	460.40	5,879	8.3E-07	1.0E+01	X	
75014	Vinyl chloride (chloroethene)	1.86E+01	1.06E-01	1.23E-05	8.80E+03	1.10E+00	2.69E-02	25	259.25	432.00	5,250	8.8E-06	1.0E-01		
75058	Acetonitrile	4.20E+00	1.28E-01	1.66E-05	1.00E+06	1.42E-03	3.45E-05	25	354.60	545.50	7,110	0.0E+00	6.0E-02		
75070	Acetaldehyde	1.06E+00	1.24E-01	1.41E-05	1.00E+06	3.23E-03	7.87E-05	25	293.10	466.00	6,157	2.2E-06	9.0E-03		
75092	Methylene chloride	1.17E+01	1.01E-01	1.17E-05	1.30E+04	8.96E-02	2.18E-03	25	313.00	510.00	6,706	4.7E-07	3.0E+00		
75150	Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.19E+03	1.24E+00	3.02E-02	25	319.00	552.00	6,391	0.0E+00	7.0E-01		
75218	Ethylene oxide	1.33E+00	1.04E-01	1.45E-05	3.04E+05	2.27E-02	5.54E-04	25	283.60	469.00	6,104	1.0E-04	0.0E+00		
75252	Bromoform	8.71E+01	1.49E-02	1.03E-05	3.10E+03	2.41E-02	5.88E-04	25	422.35	696.00	9,479	1.1E-06	7.0E-02		X
75274	Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.74E+03	6.54E-02	1.60E-03	25	363.15	585.85	7,800	1.8E-05	7.0E-02	X	X
75296	2-Chloropropane	9.14E+00	8.88E-02	1.01E-05	3.73E+03	5.93E-01	1.45E-02	25	308.70	485.00	6,286	0.0E+00	1.0E-01		
75343	1,1-Dichloroethane	3.16E+01	7.42E-02	1.05E-05	5.06E+03	2.30E-01	5.61E-03	25	330.55	523.00	6,895	0.0E+00	5.0E-01		
75354	1,1-Dichloroethylene	5.89E+01	9.00E-02	1.04E-05	2.25E+03	1.07E+00	2.60E-02	25	304.75	576.05	6,247	0.0E+00	2.0E-01		
75456	Chlorodifluoromethane	4.79E+01	1.01E-01	1.28E-05	2.00E+00	1.10E+00	2.70E-02	25	232.40	369.30	4,836	0.0E+00	5.0E+01		
75694	Trichlorofluoromethane	4.97E+02	8.70E-02	9.70E-06	1.10E+03	3.97E+00	9.68E-02	25	296.70	471.00	5,999	0.0E+00	7.0E-01		
75718	Dichlorodifluoromethane	4.57E+02	6.65E-02	9.92E-06	2.80E+02	1.40E+01	3.42E-01	25	243.20	384.95	9,421	0.0E+00	2.0E-01		
76131	1,1,2-Trichloro-1,2,2-trifluoroetha	1.11E+04	7.80E-02	8.20E-06	1.70E+02	1.97E+01	4.80E-01	25	320.70	487.30	6,463	0.0E+00	3.0E+01		
76448	Heptachlor	1.41E+06	1.12E-02	5.69E-06	1.80E-01	6.05E+01	1.48E+00	25	603.69	846.31	13,000	1.3E-03	1.8E-03		X
77474	Hexachlorocyclopentadiene	2.00E+05	1.61E-02	7.21E-06	1.80E+00	1.10E+00	2.69E-02	25	512.15	746.00	10,931	0.0E+00	2.0E-04		
78831	Isobutanol	2.59E+00	8.60E-02	9.30E-06	8.50E+04	4.83E-04	1.18E-05	25	381.04	547.78	10,936	0.0E+00	1.1E+00		X
78875	1,2-Dichloropropane	4.37E+01	7.82E-02	8.73E-06	2.80E+03	1.15E-01	2.79E-03	25	369.52	572.00	7,590	1.9E-05	4.0E-03	X	
78933	Methylethylketone (2-butanone)	2.30E+00	8.08E-02	9.80E-06	2.23E+05	2.29E-03	5.58E-05	25	352.50	536.78	7,481	0.0E+00	1.0E+00		
79005	1,1,2-Trichloroethane	5.01E+01	7.80E-02	8.80E-06	4.42E+03	3.73E-02	9.11E-04	25	386.15	602.00	8,322	1.6E-05	1.4E-02		X
79016	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.47E+03	4.21E-01	1.03E-02	25	360.36	544.20	7,505	1.1E-04	4.0E-02	X	
79209	Methyl acetate	3.26E+00	1.04E-01	1.00E-05	2.00E+03	4.84E-03	1.18E-04	25	329.80	506.70	7,260	0.0E+00	3.5E+00		X
79345	1,1,2,2-Tetrachloroethane	9.33E+01	7.10E-02	7.90E-06	2.96E+03	1.41E-02	3.44E-04	25	419.60	661.15	8,996	5.8E-05	2.1E-01		X
79469	2-Nitropropane	1.17E+01	9.23E-02	1.01E-05	1.70E+04	5.03E-03	1.23E-04	25	393.20	594.00	8,383	2.7E-03	2.0E-02		
80626	Methylmethacrylate	6.98E+00	7.70E-02	8.60E-06	1.50E+04	1.38E-02	3.36E-04	25	373.50	567.00	8,975	0.0E+00	7.0E-01		
83329	Acenaphthene	7.08E+03	4.21E-02	7.69E-06	3.57E+00	6.34E-03	1.55E-04	25	550.54	803.15	12,155	0.0E+00	2.1E-01		X
86737	Fluorene	1.38E+04	3.63E-02	7.88E-06	1.98E+00	2.60E-03	6.34E-05	25	570.44	870.00	12,666	0.0E+00	1.4E-01		X
87683	Hexachloro-1,3-butadiene	5.37E+04	5.61E-02	6.16E-06	3.20E+00	3.33E-01	8.13E-03	25	486.15	738.00	10,206	2.2E-05	7.0E-04		X
88722	o-Nitrotoluene	3.24E+02	5.87E-02	8.67E-06	6.50E+02	5.11E-04	1.25E-05	25	495.00	720.00	12,239	0.0E+00	3.5E-02		X
91203	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	4.82E-04	25	491.14	748.40	10,373	0.0E+00	3.0E-03		

91576	2-Methylnaphthalene	2.81E+03	5.22E-02	7.75E-06	2.46E+01	2.12E-02	5.17E-04	25	514.26	761.00	12,600	0.0E+00	7.0E-02		X
92524	Biphenyl	4.38E+03	4.04E-02	8.15E-06	7.45E+00	1.23E-02	2.99E-04	25	529.10	789.00	10,890	0.0E+00	1.8E-01		X
95476	o-Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.12E-01	5.18E-03	25	417.60	630.30	8,661	0.0E+00	7.0E+00		X
95501	1,2-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	1.56E+02	7.77E-02	1.90E-03	25	453.57	705.00	9,700	0.0E+00	2.0E-01		
95578	2-Chlorophenol	3.88E+02	5.01E-02	9.46E-06	2.20E+04	1.60E-02	3.90E-04	25	447.53	675.00	9,572	0.0E+00	1.8E-02		X
95636	1,2,4-Trimethylbenzene	1.35E+03	6.06E-02	7.92E-06	5.70E+01	2.52E-01	6.14E-03	25	442.30	649.17	9,369	0.0E+00	6.0E-03		
96184	1,2,3-Trichloropropane	2.20E+01	7.10E-02	7.90E-06	1.75E+03	1.67E-02	4.08E-04	25	430.00	652.00	9,171	5.7E-04	4.9E-03	X	
96333	Methyl acrylate	4.53E+00	9.76E-02	1.02E-05	6.00E+04	7.68E-03	1.87E-04	25	353.70	536.00	7,749	0.0E+00	1.1E-01		X
97632	Ethylmethacrylate	2.95E+01	6.53E-02	8.37E-06	3.67E+03	3.44E-02	8.40E-04	25	390.00	571.00	10,957	0.0E+00	3.2E-01		X
98066	tert-Butylbenzene	7.71E+02	5.65E-02	8.02E-06	2.95E+01	4.87E-01	1.19E-02	25	442.10	1220.00	8,980	0.0E+00	1.4E-01		X
98828	Cumene	4.89E+02	6.50E-02	7.10E-06	6.13E+01	4.74E+01	1.16E+00	25	425.56	631.10	10,335	0.0E+00	4.0E-01		
98862	Acetophenone	5.77E+01	6.00E-02	8.73E-06	6.13E+03	4.38E-04	1.07E-05	25	475.00	709.50	11,732	0.0E+00	3.5E-01		X
98953	Nitrobenzene	6.46E+01	7.60E-02	8.60E-06	2.09E+03	9.82E-04	2.39E-05	25	483.95	719.00	10,566	0.0E+00	2.0E-03		
100414	Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.22E-01	7.86E-03	25	409.34	617.20	8,501	1.1E-06	1.0E+00		
100425	Styrene	7.76E+02	7.10E-02	8.00E-06	3.10E+02	1.12E-01	2.74E-03	25	418.31	636.00	8,737	0.0E+00	1.0E+00		
100447	Benzylchloride	6.14E+01	7.50E-02	7.80E-06	5.25E+02	1.70E-02	4.14E-04	25	452.00	685.00	8,773	4.9E-05	0.0E+00	X	
100527	Benzaldehyde	4.59E+01	7.21E-02	9.07E-06	3.30E+03	9.73E-04	2.37E-05	25	452.00	695.00	11,658	0.0E+00	3.5E-01		X
103651	n-Propylbenzene	5.62E+02	6.01E-02	7.83E-06	6.00E+01	4.37E-01	1.07E-02	25	432.20	630.00	9,123	0.0E+00	1.4E-01		X
104518	n-Butylbenzene	1.11E+03	5.70E-02	8.12E-06	2.00E+00	5.38E-01	1.31E-02	25	456.46	660.50	9,290	0.0E+00	1.4E-01		X
106423	p-Xylene	3.89E+02	7.69E-02	8.44E-06	1.85E+02	3.13E-01	7.64E-03	25	411.52	616.20	8,525	0.0E+00	7.0E+00		X
106467	1,4-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	7.90E+01	9.82E-02	2.39E-03	25	447.21	684.75	9,271	0.0E+00	8.0E-01		
106934	1,2-Dibromoethane (ethylene dib	2.50E+01	2.17E-02	1.19E-05	4.18E+03	3.04E-02	7.41E-04	25	404.60	583.00	8,310	2.2E-04	2.0E-04		
106990	1,3-Butadiene	1.91E+01	2.49E-01	1.08E-05	7.35E+02	3.01E+00	7.34E-02	25	268.60	425.00	5,370	2.8E-04	0.0E+00		
107028	Acrolein	2.76E+00	1.05E-01	1.22E-05	2.13E+05	4.99E-03	1.22E-04	25	325.60	506.00	6,731	0.0E+00	2.0E-05		
107062	1,2-Dichloroethane	1.74E+01	1.04E-01	9.90E-06	8.52E+03	4.00E-02	9.77E-04	25	356.65	561.00	7,643	2.6E-05	0.0E+00		
107131	Acrylonitrile	5.90E+00	1.22E-01	1.34E-05	7.40E+04	4.21E-03	1.03E-04	25	350.30	519.00	7,786	6.8E-05	2.0E-03		
108054	Vinyl acetate	5.25E+00	8.50E-02	9.20E-06	2.00E+04	2.09E-02	5.10E-04	25	345.65	519.13	7,800	0.0E+00	2.0E-01		
108101	Methylisobutylketone (4-methyl-2	9.06E+00	7.50E-02	7.80E-06	1.90E+04	5.64E-03	1.38E-04	25	389.50	571.00	8,243	0.0E+00	8.0E-02		
108383	m-Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.00E-01	7.32E-03	25	412.27	617.05	8,523	0.0E+00	7.0E+00		X
108678	1,3,5-Trimethylbenzene	1.35E+03	6.02E-02	8.67E-06	2.00E+00	2.41E-01	5.87E-03	25	437.89	637.25	9,321	0.0E+00	6.0E-03		
108872	Methylcyclohexane	7.85E+01	7.35E-02	8.52E-06	1.40E+01	4.22E+00	1.03E-01	25	373.90	572.20	7,474	0.0E+00	3.0E+00		
108883	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01	6.62E-03	25	383.78	591.79	7,930	0.0E+00	4.0E-01		
108907	Chlorobenzene	2.19E+02	7.30E-02	8.70E-06	4.72E+02	1.51E-01	3.69E-03	25	404.87	632.40	8,410	0.0E+00	6.0E-02		
109693	1-Chlorobutane	1.72E+01	8.26E-02	1.00E-05	1.10E+03	6.93E-01	1.69E-02	25	351.60	542.00	7,263	0.0E+00	1.4E+00		X
110009	Furan	1.86E+01	1.04E-01	1.22E-05	1.00E+04	2.21E-01	5.39E-03	25	304.60	490.20	6,477	0.0E+00	3.5E-03		X
110543	Hexane	4.34E+01	2.00E-01	7.77E-06	1.24E+01	6.82E+01	1.66E+00	25	341.70	508.00	6,895	0.0E+00	2.0E-01		
111444	Bis(2-chloroethyl)ether	1.55E+01	6.92E-02	7.53E-06	1.72E+04	7.36E-04	1.80E-05	25	451.15	659.79	10,803	3.3E-04	0.0E+00		
115297	Endosulfan	2.14E+03	1.15E-02	4.55E-06	5.10E-01	4.58E-04	1.12E-05	25	674.43	942.94	14,000	0.0E+00	2.1E-02		X
118741	Hexachlorobenzene	5.50E+04	5.42E-02	5.91E-06	5.00E-03	5.40E-02	1.32E-03	25	582.55	825.00	14,447	4.6E-04	2.8E-03		X
120821	1,2,4-Trichlorobenzene	1.78E+03	3.00E-02	8.23E-06	4.88E+01	5.81E-02	1.42E-03	25	486.15	725.00	10,471	0.0E+00	2.0E-01		
123739	Crotonaldehyde (2-butenal)	4.82E+00	9.56E-02	1.07E-05	3.69E+04	7.99E-04	1.95E-05	25	375.20	568.00	9	5.4E-04	0.0E+00	X	
124481	Chlorodibromomethane	6.31E+01	1.96E-02	1.05E-05	2.60E+03	3.20E-02	7.81E-04	25	416.14	678.20	5,900	2.4E-05	7.0E-02	X	X
126987	Methacrylonitrile	3.58E+01	1.12E-01	1.32E-05	2.54E+04	1.01E-02	2.46E-04	25	363.30	554.00	7,600	0.0E+00	7.0E-04		
126998	2-Chloro-1,3-butadiene (chloropr	6.73E+01	8.58E-02	1.03E-05	2.12E+03	4.91E-01	1.20E-02	25	332.40	525.00	8,075	0.0E+00	7.0E-03		
127184	Tetrachloroethylene	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.53E-01	1.84E-02	25	394.40	620.20	8,288	3.0E-06	0.0E+00		
129000	Pyrene	1.05E+05	2.72E-02	7.24E-06	1.35E+00	4.50E-04	1.10E-05	25	667.95	936	14370	0.0E+00	1.1E-01		X
132649	Dibenzofuran	5.15E+03	2.38E-02	6.00E-06	3.10E+00	5.15E-04	1.26E-05	25	560	824	66400	0.0E+00	1.4E-02		X
135988	sec-Butylbenzene	9.66E+02	5.70E-02	8.12E-06	3.94E+00	5.68E-01	1.39E-02	25	446.5	679	88730	0.0E+00	1.4E-01		X
141786	Ethylacetate	6.44E+00	7.32E-02	9.70E-06	8.03E+04	5.64E-03	1.38E-04	25	350.26	523.3	7633.66	0.0E+00	3.2E+00		X
156592	cis-1,2-Dichloroethylene	3.55E+01	7.36E-02	1.13E-05	3.50E+03	1.67E-01	4.07E-03	25	333.65	544	7192	0.0E+00	3.5E-02		X
156605	trans-1,2-Dichloroethylene	5.25E+01	7.07E-02	1.19E-05	6.30E+03	3.84E-01	9.36E-03	25	320.85	516.5	6717	0.0E+00	7.0E-02		X
205992	Benzo(b)fluoranthene	1.23E+06	2.26E-02	5.56E-06	1.50E-03	4.54E-03	1.11E-04	25	715.9	969.27	17000	2.1E-04	0.0E+00	X	
218019	Chrysene	3.98E+05	2.48E-02	6.21E-06	6.30E-03	3.87E-03	9.44E-05	25	714.15	979	16455	2.1E-06	0.0E+00	X	
309002	Aldrin	2.45E+06	1.32E-02	4.86E-06	1.70E-02	6.95E-03	1.70E-04	25	603.01	839.37	15000	4.9E-03	1.1E-04		X
319846	alpha-HCH (alpha-BHC)	1.23E+03	1.42E-02	7.34E-06	2.00E+00	4.34E-04	1.06E-05	25	596.55	839.36	15000	1.8E-03	0.0E+00		
541731	1,3-Dichlorobenzene	1.98E+03	6.92E-02	7.86E-06	1.34E+02	1.27E-01	3.09E-03	25	446	684	9230.18	0.0E+00	1.1E-01		X
542756	1,3-Dichloropropene	4.57E+01	6.26E-02	1.00E-05	2.80E+03	7.24E-01	1.77E-02	25	381.15	587.38	7900	4.0E-06	2.0E-02		
630206	1,1,1,2-Tetrachloroethane	1.16E+02	7.10E-02	7.90E-06	1.10E+03	9.90E-02	2.41E-03	25	403.5	624	9768.282525	7.4E-06	1.1E-01		X
1634044	MTBE	7.26E+00	1.02E-01	1.05E-05	5.10E+04	2.56E-02	6.23E-04	25	328.3	497.1	6677.66	0.0E+00	3.0E+00		
7439976	Mercury (elemental)	5.20E+01	3.07E-02	6.30E-06	2.00E+01	4.40E-01	1.07E-02	25	629.88	1750	14127	0.0E+00	3.0E-04		